NIAB TAG

Agronomy Strategy 1 2019-20

Autumn Strategies

Winter oilseed rape establishment, seed rates, sowing dates, weed control, disease control, autumn pest control.
Winter cereals: seed rates, sowing dates, seed treatments.
Stubble cultivations for grass weed control

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Agronomy strategy 1:

Winter oilseed rape establishment, seed rates, seed treatments, sowing dates, weed control, disease control, autumn pest control.

Winter cereals: seed rates, sowing dates, seed treatments
Stubble cultivations for grass weed control.

Agronomy strategy 2:

Winter cereals: autumn weed control, autumn pest control.

Winter beans: establishment, seed rates, weed control.

Agronomy strategy 3:

Nitrogen, sulphur, growth regulators, spring weed control in cereals and break crops.

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Cereals and break crops: fungicide strategies.

This edition published July 2019

Designed and produced by Cambridge Marketing Limited, 01638 724100

Agronomy Strategy 1 2019-20

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Introduction

Agronomy strategy 1 outlines the NIAB TAG guidance for autumn establishment and agronomy of oilseed rape and guidelines for winter cereal establishment including post-harvest stubble treatments. Inevitably the oilseed rape topics are dominated by flea beetle influences to the extent that we have omitted a discussion of cultivation techniques in favour of listing anything that might help to establish the crop in the presence of the pest. Elsewhere cultural control in all topics features strongly, and we continue to stress the significance of sowing dates with respect to disease and weed control.

The Agronomy strategies aim to provide members with the basic autumn programmes for their own situations. As before, they will be updated as the autumn progresses in Agronomy Updates and autumn meetings, in response to weather conditions and crop growth patterns, and members can always discuss the Agronomy strategies in detail with their own regional agronomist.

We hope you find this document useful and as always we welcome any feedback.

NIAB TAG Regional Agronomy team.

1. Oilseed rape establishment – v. Cabbage stem flea beetle

Recently, 'establishment' with this crop has come to mean battling cabbage stem flea beetle to achieve reasonable crop establishment and hence a crop for the season. Therefore, rather than discuss the range of cultivation and drill options, we feel it would be more appropriate to address measures against this pest here.

Below is a list of measures which may reduce the impact of flea beetle and increase the chances of having a crop going into the autumn. Several are anecdotal or reported from members, without supporting trial data, but it is important to consider all ideas as we battle this pest which threatens the future of the crop in the UK.

None of the measures described comes with any guarantee!

- We should stress that any approaches which help the crop withstand adult feeding, or encourage the adults to feed on other plant species in the same field, without actually reducing adult numbers, will have little or no effect on numbers of larvae, so in these cases the measures discussed only apply to the early campaign whilst the crop could still be lost later.
- Insecticide treatment (see also Section 5) falls into this category. Although it can still, with good timing, have an effect on adult numbers the percentage kill achievable now is normally so low that survivors are still likely to produce sufficient larvae to damage the crop later.
- Successful, rapid establishment is essential to give the crop a competitive chance against this pest, so although it sounds obvious, any cultivation system which will retain moisture and produce a fine firm tilth will help, as is waiting for soil moisture as opposed to drilling early into dust.
- Allow rape stubbles to green up and leave the rape volunteers as long as possible. These will attract flea beetle and once alighted on a field, their flight muscles atrophy hence keeping them there, unable to move onto new rape crops even after the volunteers have been removed. There are also growers planning to plant sacrifice crops early in other fields to draw in flying beetles, then plant their intended crop once the first migrations have happened.
- Cereal volunteers sometimes appear to hide the crop from flying beetles and reduce numbers alighting on the rape crop so leaving these for as long as we dare may offset some damage. Sowing into long cereal stubbles can have a similar effect of hiding the emerging rape. Similarly, trashy seedbeds may not attract as many flying beetles as the distinction between rape plants and clean soil is less obvious.
- Sowing date: success of early or late sowing varies from one year to the next, but last season the benefit of early sowing was very clear, with later arriving flea beetles continuing to fly into crops well into October and attacking the later sowings. On balance early sowing is more likely to be successful but as discussed above it very much depends on fine, firm moist seedbeds. It is possible that earlier sowings last autumn (pre-15 August) caught some soil moisture, lack of which compromised later sowings.

  It should also be stressed that a number of the crops sown early last year established well and looked strong going into autumn, but later failed due to larval damage. Earlier sowing will likely result in higher larva numbers.
- Companion crops (white mustard has been the only reliable one in our trials) will help to reduce feeding activity on an emerging plants but again since the adults aren't killed they will still breed and produce larvae to lead a second wave of attack later.
- Again related to rapid crop establishment, seedbed (not early post-emergence) nitrogen with phosphate (e.g. DAP) is strongly advised. There are some claims that applications of sludge, chicken manure or compost also deter beetles due to associated odours but we have neither seen nor generated any trial evidence of this. However, the nutrient value of any of these will help in speeding up establishment.

- Varieties: there is growing evidence that hybrid rape shows sufficient extra early vigour, compared to conventional varieties, to be more likely to withstand and grow away from adult feeding. However again this will not influence larvae number and there is obviously a financial investment in hybrid seed which can still be lost under high beetle pressure. Home-saved seed is obviously cheaper and allows repeat attempts or robust seed rates (but not excessive – high seed rates do not dilute the damage) without significant extra costs, but we would still urge testing seed first as with any home saved sample, in particular for erucic acid.
- On a similar note, those considering Clearfield varieties for agronomy reasons may wish to plant extra home saved seed with it as a cheaper means of boosting plant numbers in the early phase. Assuming these extra plants are not then required they will be removed with the relevant chemistry.
- **Seed treatments:** Note that any seed treatment can give a slight check to speed of emergence so in this respect may make the crop more prone to flea beetle, but if planning to sow untreated seed make sure to have it tested for germination, seed-borne disease and erucic acid.
- **Lumiposa** (cyantraniliprole) may be available in some seed lots, (it is not approved for UK use but can be imported ready-applied to seed). This is an insecticide treatment but trials and growers' experience suggest it is not as effective as neonicotinoids were at their peak. Hence it may contribute to a wider programme of measures but should not be solely relied upon to control the problem.
- Other seed treatments which claim to improve emergence vigour will contribute less and although as often with such products, may in isolated cases make a difference between having or not having a crop, they would be well down the hierarchy of effective measures.
- It is also worth summarising other (fungicide) seed treatments here, as there are so few these days they do not warrant a separate section. **Thiram** (several products, protecting against damping-off diseases) is the only active available but is in its use-up period (final sales January 2019, final use, i.e. sowing date - January 2020). As mentioned above, there is also a large number of seed vigour/establishment enhancers based on bacteria, fungi or micronutrients, too many to list here with little or no independent data to support their use.

2. Oilseed rape seed rates and sowing dates

- **As discussed in Section 1**, seed rates do not help the crop against flea beetle, hence seed rate targets should not be influenced by flea beetle considerations. Plant population **in the spring** is still the main consideration and **25-40 plants/m²** is the target range for all varieties with no distinction between hybrid and conventional variety types. Under normal conditions winter plant losses are few so this range is also applicable to autumn-established plant numbers.
- With wide row spacing (e.g. of 50 cm or above, though our trials have shown that 50 cm is the widest row spacing advisable) any overcrowding within the row will lead to plant loss through self-thinning so be careful with seed rate – this could waste seed if a high seed rate was used.
- **Sowing date**: in most seasons the latest time to drill is early September in the north and mid-September in the south. Again, see Section 1 for flea beetle issues with sowing date.
- Seedbed conditions will have a big influence and soil moisture is paramount: drill when moisture is present and there is fine firm tilth with good seed/moist soil contact, rather than by calendar date.
- For one-pass tillage systems early sowing is preferred.
- If cultivating and drilling separately, the drilling window is wider and can be done later if desired.

1. Plant populations

OSR has a fair degree of tolerance to varying plant populations (20-100 plants/m^2) without yield being significantly affected. Seed rates have slowly drifted lower, based on observations that lower populations give thicker stems (assuming uniform spacing) which stand better and are more tolerant of early senescence (through better root structures), as well as an ability to better withstand stem infections (e.g. canker) and flea beetle larva feeding.

However, it is important to allow for poorer areas and general variation in establishment across the field.

- **Too low a population** could affect achieving an optimal population across the entire field (considering the variation in soil type some fields may have).
- **Too high a population** could lead to over-developed canopies and even induce early lodging, jeopardising optimal light interception (and hence yield) later in the season.

As stressed elsewhere, do not be tempted to use high seed rates in an attempt to alleviate the threat from **flea beetle** damage. Ensuring optimum seedbed conditions is the best way to ensure good establishment, not drilling more seed. In recent years in the worst-affected areas, numbers of flea beetle were so high, large areas have been lost irrespective of seed rate sown.

When calculating seed rates, having an accurate thousand seed weight (TSW) is more important compared to seed rate calculations for larger seeded crops such as cereals, where an error of 2 or 3 grams will not alter the calculation too much.

$$\textbf{Seed rate (kg/ha)} = \frac{\text{TSW (g)} \times \text{Target population (plants/m}^2\text{)}}{\text{\% establishment}}$$

Worked example:

$$\textbf{Seed rate (kg/ha)} = \frac{4.5 \text{ (g)} \times 40 \text{ (plants/m}^2\text{)}}{50 \text{ (\%)}} = \frac{180}{50} = 3.6 \text{ kg/ha}$$

Using a TSW of 6.5 grams would change the result to 5.2 kg/ha (a 30% increase). Using an establishment percentage of 70% would change the result to 2.5 kg/ha (a 30% decrease).

Table 1. Seeds sown (/m²) relative to seedbed conditions

Target plant populations	Seeds/m² sown		
	Seedbed (expected establishment)*		
	Good (70%)	Average (50%)	Poor (30%)
All varieties (25-30 plants/m²)	**35-45**	**50-60**	**85-100**

*Establishment percentage:

70% = **good**. Generally, a drilled crop (soil moist and warm at time of drilling)
50% = **moderate**. One-pass systems (soil drying out but rain expected in next few days)
30% = **poor**. Lower end of one-pass systems (soil dry and cloddy to below seed depth with no rain forecast) – consider waiting.

On variable soil types, assuming no ability to use variable seed rates, do not overestimate the level of establishment you are likely to achieve, otherwise the majority of the field may have reasonable establishment, yet the worst areas will have sub-optimal plant populations from the start.

Sowing date:
Latest sowing dates are given above, but if wishing to sow early be aware that early August sowings can be susceptible to extra pests such as cabbage root fly, as well as more prone to other problems such as aphids and herbicide soil residues.

Pest problems:
Anything that leaves a lot of straw on or near the surface, heavier soils and loose seedbeds are all factors that could encourage **slugs** and affect crop establishment. Also, to offset damage from **flea beetle** it will be even more critical to ensure the crop goes into good seedbeds to ensure it gets away quickly from any potential threat, though conversely trashy seedbeds may initially help against this pest as discussed in Section 1.

As stated above, do not be tempted to drill higher seed rates in an attempt to alleviate pressure from this pest. See also Sections 1 and 4 for discussion of sowing date and flea beetle.

3. Oilseed rape weed control

Pre/early post-emergence

Pre-emergence: although this is a better timing for the early residual (e.g. metazachlor-based) products, pre-emergence herbicides have been seen to slow establishment and render the crop more susceptible to flea beetle. Hence their popularity has declined, also growers want to see an established crop before investing in inputs, preferring to apply them early post-emergence or opting for the later post-emergence options such as propyzamide, carbetamide or halauxifen-methyl + picloram (Belkar).

However, NIAB TAG trials have recorded useful contribution to black-grass control from metazachlor products applied pre-emergence so this use should not be completely disregarded.

Early post-emergence: most early residual herbicides can be applied early-post-emergence (the main exceptions being products containing clomazone and/or napropamide) but are less effective on emerged weeds so where these are present this timing will be less effective. However as noted above leaving treatment until this time will give the crop the best chance to establish successfully where conditions are less than ideal or where heavy flea beetle pressure is expected.

1. Pre-emergence

Metazachlor (500-750 g/ha) either alone, in tank mix or in a formulated mix, e.g.

(i) + dimethenamid-P (e.g. Springbok, Muntjac, Sika)

(ii) + dimethenamid-P + quinmerac (e.g. Katamaran Turbo, Shadow, Luna)

(iii) + clomazone (e.g. Circuit Synctec, Nimbus CS, alternatively tank mix straight metazachlor and Centium)

See notes at end for individual strengths of active ingredients.

2. Early post-emergence

The above options (**with the exception of clomazone products**) can be applied post-emergence from the fully expanded cotyledon stage. By this stage it should be clear if the crop has established well enough, however as mentioned above this timing can be less effective particularly if weeds have started to emerge.

Other options:

- Ralos (metazachlor, aminopyralid and picloram; can also be used pre-emergence). Aminopyralid (also in AstroKerb) and picloram will complement the post-emergence performance of metazachlor. Check label carefully before use, particularly with respect to following crops and treated straw use.

3. Early/late post emergence

Belkar (halauxifen-methyl + picloram) can be applied as a single application from the 2-true leaf stage at 0.25 l/ha, alternatively as a sequential application of 0.25 l/ha (from 2- to 4-leaf stage), followed by a further 0.25 l/ha with a minimum interval of two weeks between applications. Later applications are possible (at a robust dose, e.g. 0.5 l/ha) up to 6-8 leaves provided this is before 1 January. In NIAB TAG trials this product has given a good spectrum of broad leaved weed control, at least as extensive as that of metazachlor products.

Other options mainly involve **propyzamide** and/or **carbetamide** and are considered the main grass weed measures, though they will be enhanced in this respect by previous metazachlor treatment as above.

Propyzamide (e.g. Kerb Flo 500 1.4 -1.7 l/ha) possibly with **carbetamide** (Crawler 2.5-3.0 kg/ha) in mix or sequence (e.g. Crawler 2.5 kg/ha in mid September followed by propyzamide in early November). Weed seed germination depth (i.e. preferably shallow) is critical in achieving good levels of control. For grass weed control both can be strengthened by mixture with a graminicide but check manufacturer's tank mix guidance.

AstroKerb SC provides enhanced broad leaf weed control against mayweed, poppy and thistle, at the 1.5 l/ha dose. However black-grass control will require the higher dose (1.7 l/ha).

Clearfield rape weed control: Clearfield rape crops allow the use of Cleravo or Cleranda, post-emergence products (hence helping with flea beetle management) which provide control of brassica weeds such as charlock, runch, hedge mustard, volunteer rape, as well as a wide range of other weeds. Application is from early post-emergence up to the eight-leaf stage, though weeds should be small and actively growing which means optimum timing treatment is September-October. Addition of Dash adjuvant to either product improves control of some difficult weeds, including volunteer wheat and barley.

- **Stewardship of herbicides:** minimising the amounts of residual herbicides (metazachlor, propyzamide and carbetamide in particular), in drinking water is a priority if these actives are to remain available. Ideally, try and apply these actives when they have the best chance to be taken up by target weeds, but also when they are less likely to remain in soils at high levels when drains are flowing.
- Metazachlor stewardship guidelines recommend a maximum rate of **750 g/ha** rather than 1,000 g/ha and to apply it by the end of September in order to try and achieve the objectives mentioned above. (1000 g/ha can be noticeably more effective than 750 g/ha in a grass weed programme though should only be considered on land with no ditches or watercourses etc).
- With **clopyralid-based** products now only approved for use after 1 March, the aim should be to complete planned herbicide applications (e.g. for mayweed) by the end of January, with any later application windows treated as a bonus, rather than part of the core plan.
- **Strong rapid crop establishment** is critical for many reasons; including helping to suppress weed growth. Minimal soil disturbance before sowing can help reduce weed germination. Selection of seed rate according to seedbed conditions and the use of starter nitrogen to promote early growth are also important factors in this respect.

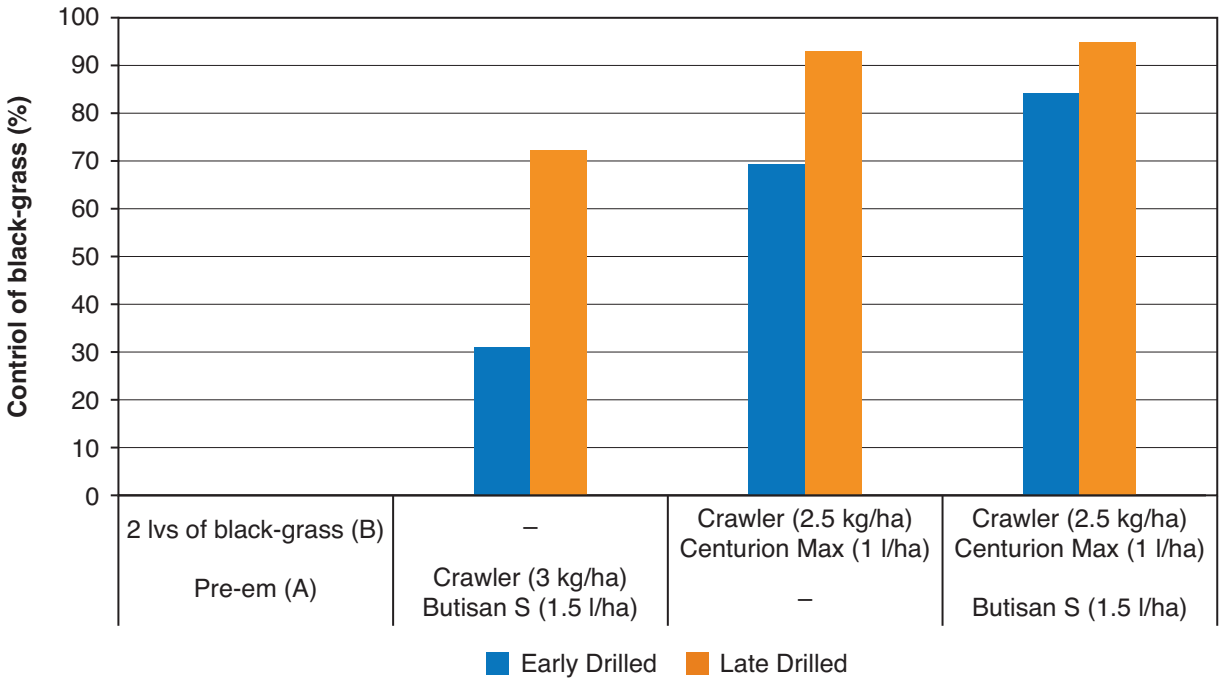
  If at all possible, avoid sowing into dry soil, particularly if no or little rain is forecast. Such conditions can induce secondary dormancy of the rape seed and this will reduce the vigour of the crop plants once they do emerge. This in turn will provide weeds with an extended opportunity to germinate and get established ahead of crop competition.

Cultivations and black-grass control

Effective black-grass control in oilseed rape can be an essential component in its management across the rotation. Level of grass-weed control in this crop is potentially high, combining one of the most competitive crops with some of the most effective herbicides. However, this should not be taken for granted. There are factors that can compromise the effectiveness of control.

- **Cultivations and establishment approach**
  Minimising the disturbance of the soil (e.g. by using a direct drill or autocast approach), so that the black-grass seed that germinates and establishes is not buried too deeply, can significantly improve control from the key active (propyzamide).
- **Timing of propyzamide application**
  In order to maximise the effectiveness of the propyzamide part of the programme it is important to wait until the soil temperatures have dropped and soil moisture content has risen to the appropriate levels.
- **Adopting a programme approach**
  Although, when considered in isolation, an autumn application of propyzamide is the most effective, incorporating the active as part of a programme (with a pre-em and a graminicide) provides the ultimate robustness (see 2017 trial below, Figure 1).
- **Poor (or absent) crop competition**
  One of the key risk factors in this crop is lack of crop competition. It is taken for granted that the oilseed rape canopy will suppress black-grass, reduce any growth of surviving plants and prevent seed return but poor crops or areas within fields where the crop establishment and growth are poor do not provide this suppression. Areas where the crop has failed often produce islands of black-grass which have survived control and will inevitably cause problems in following crops.

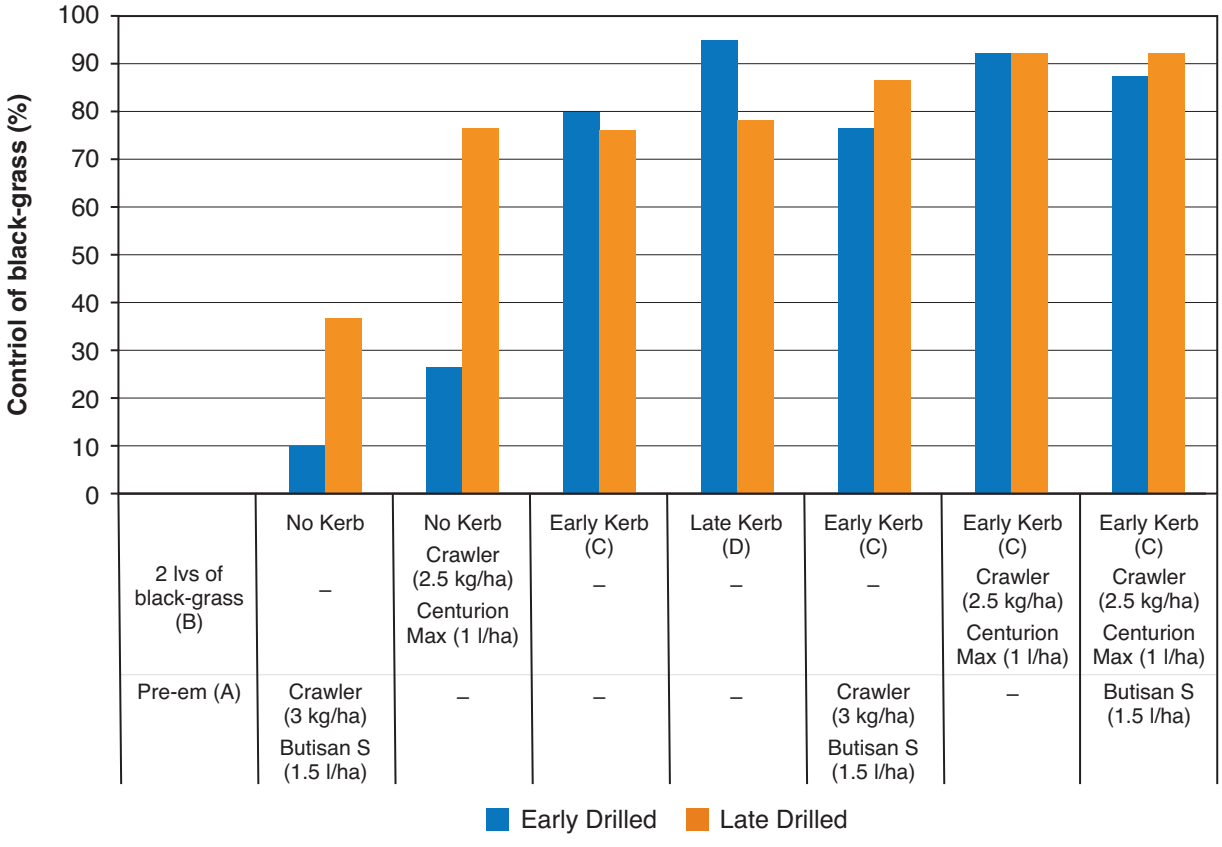
Figure 1. Black-grass control programmes and sowing date (Wragby, Lincs, 2017)



Early drilled: 13 August. Late: 6 September. Black-grass numbers in untreated: 182/m^2 early, 125/m^2 late.

There is a trend, as seen in cereal trials, for the herbicides to be more effective on the later sown crop whilst high levels of control can still be achieved with early sowings if the level of input is high enough. The two-spray programme, with metazachlor pre-emergence followed by Crawler + Centurion Max, gave the best black-grass control though this effect was more marked on the earlier sown crop. (Note the Centurion Max tank mix is not supported by the manufacturer's Best Practice guidelines for the product, and if used on farm would be at the grower's risk.)

Figure 2. Black-grass control – timing of propyzamide



With no subsequent propyzamide application (first two treatments) the sowing date effect is again evident. However once propyzamide is included in the programme these effects are smoothed out and the sowing date effects less obvious. Early Kerb was applied according to soil temperature and moisture on 31 October, the late Kerb delayed to 12 December. There is little difference in efficacy between these timings, though one would normally expect earlier sown crops to have larger grass weed plants by December and hence poorer control.

Pre-sowing glyphosate

- Although the window is short, this remains a very useful way of controlling emerged weeds. It is especially useful for black-grass, bromes and volunteer cereals, both from an anti-resistance policy and to reduce reliance on ACC-ase inhibitor herbicides.
- There are however increasing concerns about weeds potentially developing resistance to glyphosate, especially black-grass and rye-grass. The Weed Resistance Action Group (WRAG) has published guidance aimed at reducing the risk of this happening. Application prior to crop sowing without adequate follow up measures to control any surviving weeds is considered to be one of the higher risk practices.
- Therefore, if doing this; first check that this timing is on the product label for the glyphosate you are using; then either cultivate effectively enough to kill survivors, or use a herbicide programme with different modes of action to glyphosate, that will effectively control survivors.

Table 2. Main Herbicide Options for Winter Oilseed Rape 2019

Further product information, including buffer zones, can be found on ActivSmart.

Active	Example Products	Application Timing	Comments
Broad-leaved weeds			
Dimethenamid-p + quinmerac	Tanaris	Pre-em to 9 true leaves	Non metazachlor option but still weak if post-emergence of weeds
metazachlor	Butisan S, Sultan 50 SC	Pre-em – 4 leaf/end of Jan	Good start to a weed control programme, some grass-weed activity as well (useful start to black-grass control).
metazachlor + quinmerac	Katamaran	Pre-em – 6 leaves	As above plus cleaver and some poppy control at higher rates.
metazachlor + dimethenamid-p	Springbok (Muntjac)	Pre-em – 6 leaves	Improved crane's bill control at higher rates.
metazachlor + quinmerac +dimethenamid-p	Katamaran Turbo (Shadow, Luna)	Pre-em – 6 leaves	Some of everything above!
dimethachlor	Teridox	Pre-em	Similar, but narrower weed spectrum, to metazachlor. Main reason to use would be as an alternative to metazachlor if already over three year period use rate.
clomazone	Centium 360 CS	Pre-em	Similar, but narrower weed spectrum, to metazachlor. Main reason to use would be as an alternative to metazachlor if already over three year period use rate.
napropamide	Colzamid, Devrinol	Pre-em	Useful weed spectrum including poppy. Needs to be tank-mixed with another product (e.g. clomazone or metazachlor) to get broad spectrum weed control. No winter cereals for 12 months after application.

imazamox +metazachlor + Dash HC adjuvant	Cleranda	Post-em – 8 leaf stage	**Only for use on Clearfield varieties:** Need to follow stewardship guidance on the control of ALS resistant (i.e. Clearfield) volunteers. Main reason to use is good control of charlock and runch, also volunteer rape (non-Clearfield).
imazamox+ quinmerac+ Dash HC adjuvant	Cleravo	Post em 9 true leaves	**Only for use on Clearfield varieties:** quinmerac improves poppy and cleaver control
bifenox	Fox	Post-em – before flower buds visible	EAMU authorisation only for control of crane's bill, but will also give control of charlock and some control of runch. Crop needs to be well waxed for crop safety before application.
Grass and broad-leaved weeds			
propyzamide	Kerb Flo 500, Flomide, Cohort	Post-em 1 Oct – end Jan	Persistent grass-weed control and also useful control of some broad-leaved weeds, especially chickweed and speedwells.
propyzamide + aminopyralid	AstroKerb	Post-em 1 Oct – end Jan	As propyzamide, with improved broad-leaved weed control including mayweeds and poppy. Where cleavers and crane's bill are not a problem, there may be less need for earlier broad-leaved weed control, particularly with metazachlor based products. All crop residues must stay in the field (special rules for biomass fuel use though).
carbetamide	Crawler	Pre-em – end Feb	Less persistent than propyzamide and timing for best efficacy and crop safety more difficult (some growth, but not rapid growth). However, a useful alternative or addition to propyzamide in a programme.
ACC-ase Inhibitors			
clethodim	Centurion Max	Post-em – before stem extension	Good black-grass control. Best used earlier rather than later. Manufacturer "Best Use Guidance" should be followed particularly with regard to timing.
fluazifop-P-butyl	Fusilade Max	Post-em – before flower buds visible	Useful all-rounder on volunteer cereals and bromes. Good tank-mix options.
propaquizafop	Falcon	Post-em – before flower buds visible	Useful all-rounder on volunteer cereals and bromes. Good tank-mix options.
quizalofop-P-ethyl	Leopard 5 EC	Post-em – 11 weeks to harvest	Useful for volunteer cereal control.
quizalofop-P-tefuryl	Panarex	Post-em – 60 day to harvest	Useful for volunteer cereal control.
cycloxydim	Laser	Post-em – 12 weeks to harvest	Good on bromes, also rye-grass where it is not resistant. Safer in tank-mixes than other "dims".

Table Notes

1. Metazachlor – maximum dose of 1,000 g/ha over a three year period (equivalent to one full dose application), but stewardship scheme recommends a 750 g/ha limit.

2. Dimethachlor – 10 metre aquatic buffer zone. Only use once every three years.

3. Clomazone – temporary crop bleaching possible.

4. Metazachlor, propyzamide, and carbetamide are all particularly common problem pesticides that occur in water. Follow best practice guidance to avoid water pollution.
   See www.voluntaryinitiative.org.uk for further details.

5. ACC-ase inhibitors are particularly prone to control of black-grass being compromised due to weed resistance. An ACC-ase active ingredient can only be applied once to a crop. If a second ACC-ase product is required, it must contain a different active and be applied to different target weeds.

6. Propyzamide/carbetamide. A tank mix of the two actives is mentioned above as a possible treatment for problem grass weeds. We should point out that Corteva do not support the tank mixing (or sequential application) of propyzamide and carbetamide due to concerns over the risk to water contamination with these active ingredients.

   As seen above, in NIAB TAG trials these tank mixes have been effective but no better than either carbetamide or propyzamide mixed with a foliar graminicide (where there is no significant resistance to these).

7. EAMU authorisation = Extension of Authorisation for Minor Use. Use is at grower's risk and the user must have a copy of the relevant EAMU document before use. These are available to download from https://secure.pesticides.gov.uk/offlabels/search.asp

4. Oilseed rape pest control

Cabbage stem flea beetle (CSFB) – adults

Members will be well aware how difficult to control this pest is, mainly because of a loss in efficacy from chemical options:

a) resistance to pyrethroid insecticides is now widespread

b) other foliar sprays are less effective than pyrethroids were against beetle species.

Cultural control measures are at least as effective as insecticides against adult beetles and are covered in **Section 1**.

Chemical control may have some effect but cannot be relied on and whilst it may have to be tried it will not be more effective than many of the cultural control options previously discussed.

- Once emerged, crops should be monitored for shot-holing of cotyledons and chemical control considered if this is widespread. Pyrethroids may have some effect and may be worth trying in the first instance but if ineffective **do not apply** repeat treatments **unless** you are clearly targeting a fresh flight-in (in 2018 there were at least two migrations into crops in many areas).
- Damage becomes less significant as the plants grow, and if no damage is seen up to the two true leaf stage then treatment is unlikely to be beneficial. If the flea beetles recover from a treatment and resume feeding before the crop reaches the four leaf stage then a repeat treatment may be necessary but if an earlier pyrethroid treatment apparently had little or no effect then further treatment is not worthwhile.
- Do not treat prophylactically as over-use of these insecticides will further encourage the development of resistance.
- Close monitoring is particularly important in areas where high levels of damage were seen last year, and/or high numbers of larvae were found in stems and petioles in autumn/winter.
- The current AHDB threshold guidance for adult flea beetle damage is to treat only if more than 25% of the leaf area is lost by the 1-2 true leaf stage, or more than 50% is lost by the 3-4 true leaf stage, or in either case if the crop is being eaten faster than it is growing.
- It is believed that most insecticide options are only effective on CSFB if the spray actually lands on the beetle. Secondary exposure via contact with sprayed leaves is not thought to be significant. As a result, coverage and timing is critical. Spraying when the beetles are more active may be more effective, this may be the middle of the day or even at dusk or after dark. Careful monitoring will be needed to see when they are active.
- Crop establishment can be slowed or worse by SU residues in the soil following late application of these to a previous crop, particularly following dry springs. This can leave the crop more prone to damage and so would influence cultivation strategy to minimise such residues.
- **Slug and flea beetle symptoms:** initial slug and flea beetle damage can look very similar. Early flea beetle damage will usually consist of very precisely made ‘pin prick’ holes in the cotyledons and first leaves. As leaves expand, the shape of the initial damage is distorted. Slug damage, particularly if coming from the underside of the leaves, can also have a similar ‘precise’ appearance if just viewed from above. If leaves are turned over, the more characteristic ‘rough feeding’ of slugs should be apparent. There should also be some evidence of mucus trails on the leaves or soil surface close to plants if the damage is being caused by slugs, which themselves can be very small and difficult to see at this stage.
- **Cabbage stem flea beetle – larvae**
  Damaging numbers of larvae within stems and petioles can and have occurred even where adult damage was not very obvious and there is a very poor correlation between adult and larvae numbers. Few adults can produce many larvae. Effectively these represent two separate pests with limited insecticidal control of the adults and no effective chemical control of the larvae. If larval numbers are high the only option is to wait and see if the crop recovers.

(Defoliation, i.e. mowing the crop whilst the larvae are still in the leaf petioles can reduce damage by reducing the number that migrate to the main stem. This would need to be done promptly as migration to the stem can occur in early winter).

Slugs

- Although slugs can destroy whole fields at early emergence, they are only usually a critical pest for a relatively short period of time. The highest risk period is at crop emergence and the highest risk crops those that have been established by auto-casting, direct drilling or sub-casting.
- For these crops, monitoring slug activity on the surface using chicken layers mash or similar as bait before and immediately after sowing is vital. If there is any appreciable activity, slug pellets should be applied immediately.
- Metaldehyde's loss of approval means it can be used up to 30 June 2020 but cannot now be purchased (post 30 June 2019). If metaldehyde-based pellets are to be used to protect emerging oilseed rape they are probably less risky to the environment than use later in the autumn but growers should try and use **ferric phosphate** products throughout or at least in the higher risk fields or in higher risk weather/soil conditions. Price differentials are much smaller now and both products give similar levels of control.
- If using metaldehyde, it is still important to follow the stewardship guidelines.
- Cultivations themselves can reduce slug numbers and crops established by techniques that cultivate the whole soil surface, such as shallow non soil inversion or ploughing are at less risk from serious slug attack at emergence, but can be at risk later and would not be safe until after the 2-3 true leaf stage. Monitoring surface activity of slugs as mentioned above can be done post-sowing in these crops, and pellets may only need to be applied if significant activity or leaf damage is seen. Usually, a single well timed application of pellets will be sufficient to get crops through the risk period if growing conditions are good.

Aphids

- The vector of **Turnip Yellows Virus** (*Myzus persicae*) is widely resistant to pyrethroids and in the absence of insecticide seed treatments the only options for control are non-pyrethroids such as **Plenum** (pymetrozine) and **Biscaya** (thiacloprid). Aphids do not attack crops every season however, so treatment should not be prophylactic. Check for evidence of the pest, taking guidance from monitoring services such as the RRES Insect Survey suction trap data. Treat if aphids are easily found in the young crop (prior to 4-5 leaf stage).
- In our own trials we have recorded significant levels of virus infection but not from the early aphid infestation described, and although we recorded reductions in virus infection from foliar insecticides these were inconsistent and did not generate yield responses.
- Full dose of Plenum is 0.3 kg/ha, but, though not supported by the manufacturer, some trials suggest that 0.2 kg/ha is as effective if an adjuvant (MSO) is added.
  (Plenum is in its use-up period and cannot now be purchased.)

Other pests

Turnip sawfly is an occasional pest in mild autumns transferring from, among other sources, stubble turnip crops. The black caterpillars smothering plants can be quite dramatic, and damage is through this defoliation. There are cases every year of whole fields being lost to this pest so monitor regularly. Pyrethroid sprays are still effective.

Cabbage Root Fly, as its name suggests, attacks the roots of seedlings and young plants which show signs of wilting. It is only likely to be a problem on crops established before mid August, which 'catch' the later generations of the pest.

5. Oilseed rape disease control

Autumn fungicides target **phoma** and **light leaf spot**. Phoma needs to be monitored and treated if necessary, occasionally (as in autumn 2017) it arrives early and needs separate treatment. Light leaf spot is the more serious and widespread of the two and needs to be routinely treated even though symptoms are unlikely to be seen in autumn.

- **If phoma is found before mid-October:**
  Check crops regularly for the arrival of **phoma leaf spotting**. If threshold for treatment is reached (one plant in ten with any infection) before mid-October, apply:

  Plover (difenoconazole) 0.25 l/ha

  Follow 3-4 weeks later with

  Proline 275 (prothioconazole) (0.3-) 0.4 l/ha
  or a prothioconazole/tebuconazole formulated product (Prosaro 0.9 l/ha or Kestrel 0.7 l/ha)

  Difenoconazole will not give adequate control of light leaf spot so the follow-up is important. The second spray will also control further infections of phoma should they develop.

- **If Phoma is first seen after mid-October:**
  If phoma threshold is not reached by mid-October apply, by early November:

  Proline 275 (prothioconazole) 0.4 l/ha
  or a prothioconazole/tebuconazole (Prosaro/Kestrel) as above, to control both phoma and light leaf spot

  Do not wait for light leaf spot symptoms to appear.

  This treatment will give control of light leaf spot as well as any late-arriving phoma.

- Varieties with good resistance to light leaf spot (7 or above) may not respond to autumn treatment so if phoma does not appear, an autumn fungicide may not be necessary. However, treatment in spring cannot be ruled out if disease pressure builds sufficiently. An exception would be Barbados (LLS rating 8) which has consistently shown little or no response to fungicides in our trials.
- A two-spray autumn programme is only needed where phoma arrives before mid-October and one treatment will not protect the crop for the whole of the autumn. Light leaf spot should only require a single autumn spray and the timing is fairly flexible.
- Check crops in early January as in seasons of high light leaf spot pressure treatment has been needed then, well ahead of the next standard timing of stem extension.
- Tebuconazole in Prosaro (with prothioconazole) or in Agate EW (with prochloraz) will back-up light leaf spot control but also give some degree of growth regulation if this is needed.
- Metconazole (Caramba/Sunorg Pro etc) will also give growth regulation but is not as effective a fungicide as the above options, so would be better tank mixed with a more effective product.

Phoma

- The arrival of phoma in rape crops is variable, but it can occur early and possibly from the first true leaf stage at which point infection of the stem is a short journey and early stem canker formation will ensue. On the other hand, the later that first infections appear on the foliage, the further the fungus has to grow to reach the stem and the less time it has to form a damaging stem canker. Hence infections arriving after the end of the year are unlikely to cause yield reductions.
- Products used for phoma are largely protectant and have limited eradicant activity. As a result, do not delay treatment when the 10% of plants threshold is reached, though selecting varieties with better disease resistance to light leaf spot and phoma would reduce disease pressure.

Light leaf spot

- Levels seen in most crops last spring were again low so inoculum carry-over this autumn is unlikely to be high. However, since we are trying to control spring infection with autumn treatment we cannot know the disease pressure next spring so need to employ routine light leaf spot treatment.
- Although light leaf spot symptoms are rarely seen in autumn, the ability to control it in spring has relied strongly on how well it is targeted in autumn. This means use of prothioconazole-based treatments; as crops treated with tebuconazole or difenoconazole alone in autumn have seen very early symptoms of light leaf spot in spring.
- Due to its plant growth regulatory activity, high doses of tebuconazole or metconazole should not be used on small crops.

Verticillium

Verticillium longisporum is the species that can be a problem in oilseed rape and there are an increasing number of farms where the disease has become well established and hence is potentially damaging in some seasons.

Saving seed from crops known to be infected should be discouraged, and new seed bought in. Also, ensuring a good root system develops from the off will help, again this points to good seedbed conditions as discussed in earlier sections, with seedbed N and early timing of spring N treatments.

Symptoms of this disease are not easy to see in the field until very late in the season and can also easily be confused with some other diseases that cause premature ripening, especially phoma.

NIAB TAG offer a soil test to detect the presence or absence of verticillium (see Technical Services/ Laboratory Services at www.niab.com) and herbicide soil residues.

Clubroot

This disease is also becoming a major problem on an increasing number of farms. In England, it is most common in the west side of the country, but has been an established problem in eastern Scotland for a long time.

Control is difficult but the main measures that can be taken are:

- **Resistant varieties** – the most reliable way of living with this disease. However, such varieties (e.g. Crome, Mentor) should not be grown too frequently, otherwise pathogen populations may evolve to overcome the resistance. Other measures should still be employed.
- **Longer rotations** can help in the management of this disease and soil testing can also help predict potential future disease severity as part of a farm wide management policy. The NIAB TAG laboratory offers this service.
- **Avoid soil acidity** – application of a finely ground calcium-based liming material close to sowing time can help a crop avoid severe infection, but has proven to be less reliable than the use of resistant varieties.

Warm (over 16°C) and wet soils during early crop establishment favour this disease.

Downy mildew is a disease that is favoured by humid conditions. There are no good foliar fungicide options available in oilseed rape. It does not often cause serious problems, except where favourable conditions persist when a newly emerged crop is not able to grow through such a period. Symptoms can easily be confused with the early symptoms of phoma; so be aware of this. Downy mildew will show some mealy looking fungal growth on the underside of infected leaves, with an associated discolouration of the upper side of the leaf – which can look like the start of a phoma infection.

Varieties are not screened for resistance or susceptibility to this disease; so any acquired local experience of varietal differences are worth noting if it has historically been a serious problem.

6. Stubble management for grass weed control

This section discusses the latest thoughts on approaches to post-harvest cultivations, which have been an important part of grass weed control for some time

Stale seedbeds can be a useful way of reducing the seed bank but in some situations they can work against this.

1. Black-grass

Stale seedbeds prior to a winter crop

A stale seedbed is formed by shallow cultivation of cereal or break crop stubbles immediately after harvest, followed by consolidation with press or rolls. This will provide optimum conditions for seed germination and prompt emergence of grass weeds, then to be controlled with glyphosate. They are not always successful, however, and the circumstances under which they should be created are as follows:

Wet harvest and/or post-harvest period (such that soil has reasonable moisture) – create a stale seedbed as soon as possible, to optimise conditions for grass weed germination and emergence.

Dry harvest and post-harvest period – soil is dry with no certainty of imminent wetting – leave stubble untouched for as long as practicable, if possible until the soil is wetted again.

The above distinction comes from research which suggests the loss of black-grass seeds (and so presumably of other species) through natural causes may have been underestimated. If left on the surface and exposed to the elements, seeds can die through weathering or be consumed by wildlife. If soils are dry such that attempts to encourage germination by 'sowing' in a stale seedbed are unlikely to succeed, then overall losses of seed by natural means as described will be greater (and burying the seed will protect it from this).

If there is moisture in the soil then the losses through germination and greening-up are likely to be greater than from natural losses so a stale seedbed should be prepared as described.

Cultivations for a spring crop

Recent work at our Black-grass Centre compared seedbed preparation, before spring barley, either in autumn or just prior to drilling, in terms of success in reducing black-grass numbers in the crop. Results show that black-grass numbers in the spring barley crop were higher if the stubble was cultivated just before sowing.

This suggests the best approach would be to cultivate in autumn, leave the soil untouched until drilling, then spray off and aim to direct drill or drill with minimum soil disturbance. However, where the autumn cultivation (inversion or non-inversion) is successful in promptly stimulating large numbers of black-grass plants, these should be sprayed off well before sowing otherwise they will be difficult to control and may interfere with seedbed preparation and subsequent in-crop herbicide performance. Hence autumn cultivation is the best approach but the effects should be monitored closely and early action taken if needed.

Experience shows that multiple stale seedbeds through the winter period are no more successful.

2. Bromes

For **all brome** species **ploughing** is more effective than non-inversion tillage so some ploughing in the rotation will help keep on top of them.

Sterile and Great brome

Where not ploughing, shallow-cultivate stubbles **no deeper than 5 cm** immediately after harvest to cover seeds and encourage germination prior to spraying-off. Leaving seeds on the surface will induce dormancy and work against germination before drilling.

Soft and Meadow brome

If not ploughing, **leave stubbles uncultivated** for at least a month after harvest – early cultivation will delay the breaking of dormancy in these brome species, making effective pre-drilling control and subsequent herbicide timing difficult.

Mixture of brome species

Where there is a mixture of brome species previous advice has been to treat stubbles as for sterile/great brome as these would be more difficult to control chemically. This may not be the case now with brome products being effective on all species, also some members who have followed this advice now report a significant problem with other brome species (meadow brome in particular has been a common 'new problem' for growers). If contrasting cultivation strategies are called for the best option is to base it on relative numbers, i.e. whichever species is the greater problem.

3. Wild-oats

Cultural control methods involving cultivations, stale seedbeds etc have less effect on wild-oats than on other grass weeds due to their protracted emergence and depth of emergence. However, leaving freshly shed wild-oat seed for as long as possible on the soil surface after harvest may be beneficial, increasing seed losses through weathering and predation.

4. Rye-grasses

Stale seedbeds may have some benefit but may not give high levels of control since the germination period is prolonged, more so than in black-grass for example.

7. Winter cereal sowing date

Sowing date has a profound influence on weed, pest and disease pressure throughout the growing season and hence remains a valuable agronomy tool. Delayed drilling remains an effective means of cultural control of grass weeds and can have a significant influence on disease and lodging pressure, and hence expenditure in these areas.

Our trials have shown that delaying drilling until the first week in October can have a significant effect when trying to control grass weed populations, and therefore on herbicide expenditure. This is an important consideration due to increasing variability of control from herbicide products and an integrated management plan, including cultural control methods, must be considered.

In addition, whilst early sowing can produce a vigorous crop, grass weeds will also be more vigorous and this leads to a greater reliance on chemical control, often attempting chemical control methods in non-optimal conditions i.e. when soils are dry. In comparison later sowing will produce smaller and less vigorous grass weeds which can be better controlled using residual herbicides when soil conditions are more appropriate i.e. more soil moisture.

Fields worst affected by grass weeds should ideally be sown towards the end of the drilling schedule. September should be avoided altogether. As ever these considerations should be adjusted to individual farm conditions (including soil type and availability of machinery) and will be subject to weather conditions.

Early September (1st-15th)

It is important to remember that sowing this early poses a number of threats to the crop and is only advisable if the potential risks have been assessed and are considered manageable. Grass weeds, higher season-long disease pressure and the loss of Deter seed treatment for BYDV control mean this drilling window is strongly discouraged for all but the most northerly farms.

Potential problems include the crop being exposed to:

- A longer window of aphid pressure
- High early disease pressure which can continue through spring
- Early emerging weeds

These issues are more relevant in the south, but in all areas the following points should be considered:

Table 3. For early September sowing:

Variety choice	Variety should be stiff strawed, disease resistant and slow developing.
Weed control	Weed growth will be more vigorous in warm seed beds and this will put pre-emergence herbicides under pressure. Weeds may emerge as the activity of the herbicides is starting to decline.Where residual herbicides are planned, let conditions suited to their performance influence sowing date.
Seed rate	Seed rates are critical for early sowing as if they are too low the crop will not be able to compete with the weeds present. If the seed rate is too high, however, the crop will produce an excessively thick canopy and be more vulnerable to disease and lodging. (See **Section 8 – cereal seed rates** for guidance)
Aphids and Gout fly	Control of these pests will need attention from the early stages of crop establishment. With no Deter seed treatment available we must rely on insecticide sprays to control these, particularly aphids in order to minimise the risk of damage from BYDV. For aphid control, two foliar sprays may be needed for early September sown crops with the first applied around the two leaf stage. Multiple applications in this way will encourage resistance development though this may be avoidable if the AHDB monitoring system for aphid generation time is followed, rather than routine treatment. BYDV programmes usually take care of gout fly also.
Disease	In early sown crops you can expect disease, particularly rusts, to appear fairly promptly. Autumn treatment is only required in extreme circumstances and in very susceptible varieties. Susceptible varieties should be monitored closely and treated with a triazole-based spray in autumn or early spring if rust develops.

Ideally early-mid September sowing should be restricted to fields with:

- Low grass weed pressure
- A good quality seedbed to encourage even emergence
- A variety planned with good disease resistance profile

Remember input costs are invariably higher with early sowings and higher yields are not guaranteed. Growers must take extra care to monitor weed, pest and disease pressure in early sown crops.

Mid-Late September

Once considered the normal start time for cereal planting, mid-September drilling should produce more-manageable crops, as the agronomic issues discussed above become less of a threat but for grass weed and BYDV management this is still too early.

Typically at this time aphid control can be achieved using a strong pyrethroid (e.g. Hallmark Zeon, Decis, Contest) at the two-leaf stage but repeat application cannot be ruled out, raising the concerns discussed above.

Gout fly can sometimes be seen in crops in the south at this stage, but infestation levels are typically low and rarely affect yield.

Second wheats can be sown at this time provided an effective take-all seed treatment is used. To further control take-all other measures such as high, early doses of spring nitrogen may also be required.

This window is also appropriate for starting **winter barley** drilling, as the crop is more sensitive to excessively early or late sowing than wheat. If growing hybrid winter barley varieties then early September sowing should be avoided.

Late September – Early October

Agronomically, this is the optimal time to sow wheat in terms of management and level of input required. Waiting until this time, however, creates a narrower drilling window and in some areas/seasons may not be feasible. Nevertheless for areas at high risk from BYDV, or with high grass weed pressure, this may still be considered too early.

It is important to remember that as October progresses, yield potential will start to decrease, particularly on light, drought-prone soils or in the north where early development is generally slower and late sowing will exacerbate this. Delaying drilling to this stage can be particularly challenging where larges acreages are concerned. Field selection is key to manage risks associated with different sowing dates.

Winter oat crops are typically sown during this window.

Mid October – Mid November

This window of drilling is also more vulnerable to adverse weather conditions and in wet years growers may be limited by the inability to travel on wet soils. In the north (north of the Humber) such late drilling is impractical due to the uncompetitive crops resulting and if grass weed pressure discourages earlier sowing then a change of crop, or a delay to spring, is often the only option.

Whilst crops sown during this period will be under less pressure from grass weeds and disease, particularly septoria, yellow rust and BYDV, the yield potential of the crop is subject to a potentially significant decrease. Nevertheless, in the south at least, we are moving towards having to accept these losses if we are to manage the problems discussed.

Varieties: KWS Kerrin, RGT Gravity, KWS Jackal, Gleam and LG Skyscraper are all suitable for later drilling.

To reiterate the suitability of sowing dates where **black-grass** is a significant problem:

September sowing – not an option

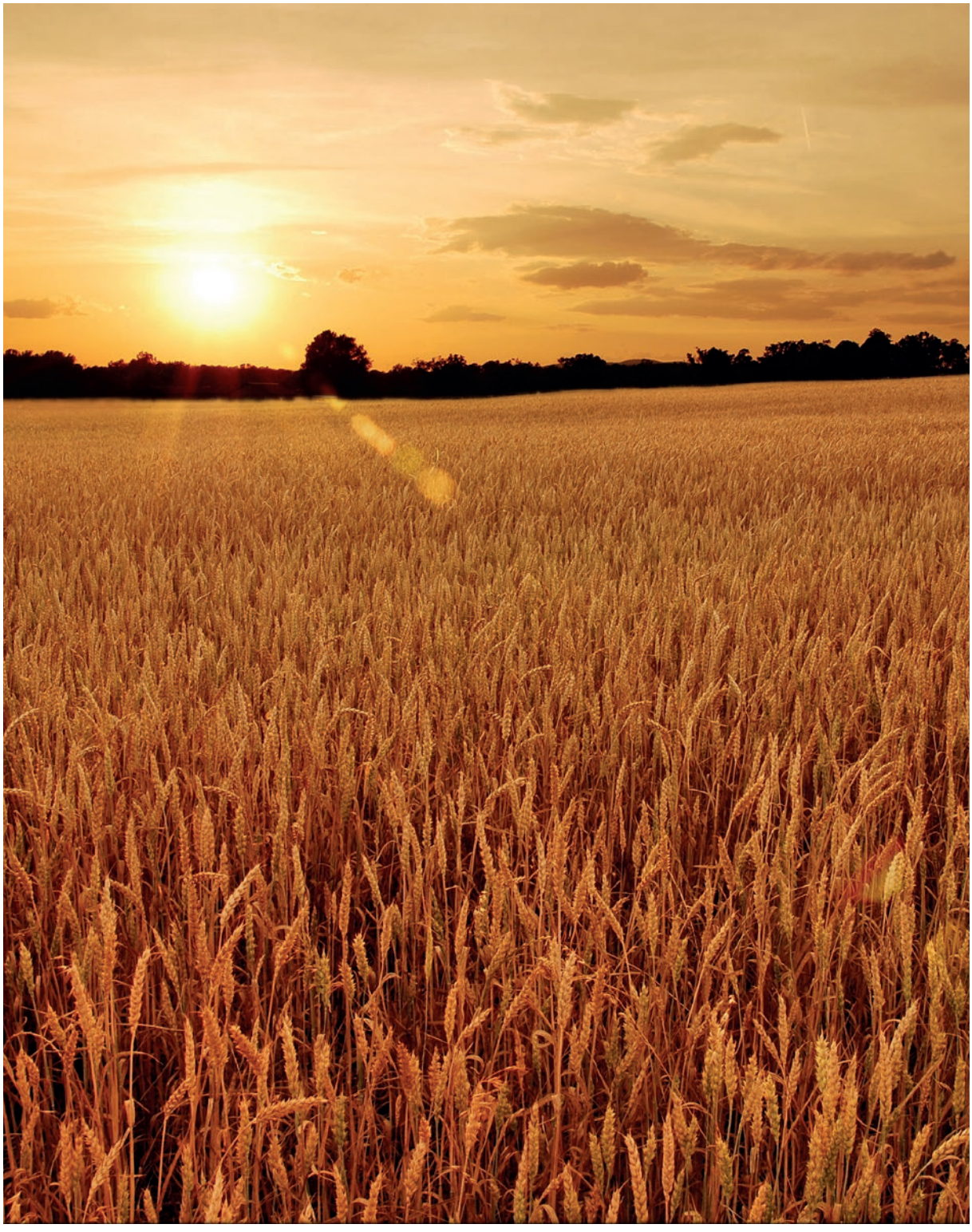
First week October – this would be considered early in black-grass situations and is only suitable where low populations are expected.

Second to fourth week of October – typical sowing period.

Last week in October – for fields with particularly difficult black-grass.

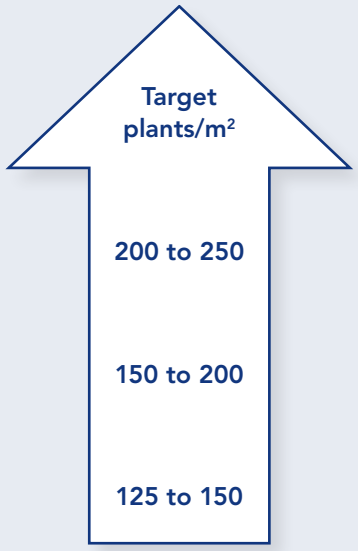
November sowing offers further benefits but yield penalties and likely uncompetitive crops discussed above means that realistically the next drilling window (after October) is spring.

Recent autumns have helped follow the above guidelines but in wetter autumns all drilling may have to be brought forward (though wetter conditions would hopefully also encourage more pre-sowing emergence of grass weeds).



8. Seed rates and target plant populations for winter cereals

Winter Wheat



Sowing Dates:

Mid – late October (250-350 seeds/m²)

Late September – early October (200-300 seeds/m²)

Early September (pre-15th) (150-200 seeds/m²)

The target plant populations given above require good seedbed quality and sufficient moisture levels to promote good crop establishment from the associated seed rates. If this is not the case then seed rates will need to be adjusted accordingly to compensate for potential losses through poor establishment.

Higher seed rates will be required if:

- Drilling is late
- In black-grass situations
- Seed beds are poor (wet and cloddy)
- Slug population is high
- Establishment conditions are excessively dry or wet

Plant populations continue to be one of the most important cultural grass weed control measures, as shown at our Black-grass Centre, and are more effective in this respect than variety choice i.e. variety tillering characteristics. Therefore, seed rates should be relatively high (at the higher ends of the ranges above) in situations where grass weeds are an issue.

Early September-drilled wheat

If drilling in early September on light soils or dry seedbeds then the higher part of the range shown above would be appropriate as, in these conditions, establishment can be compromised.

When selecting a variety for this period of drilling remember that varietal disease resistance will have a bearing, as will straw length, particularly on heavier soils. A stiff, slow-developing variety will allow you to drill at the more secure, higher rates suggested.

Sowing in early September is not advised where significant populations of grass weeds are anticipated.

In any drilling window, when deciding on seed rate it is important to remember that higher seed rates are associated with higher disease and lodging pressure and so variety selection and sowing date must be appropriate for the higher rates.

Winter barley

Conventional varieties – 200-250 plants/m² (e.g. 250-300 seeds/m²)

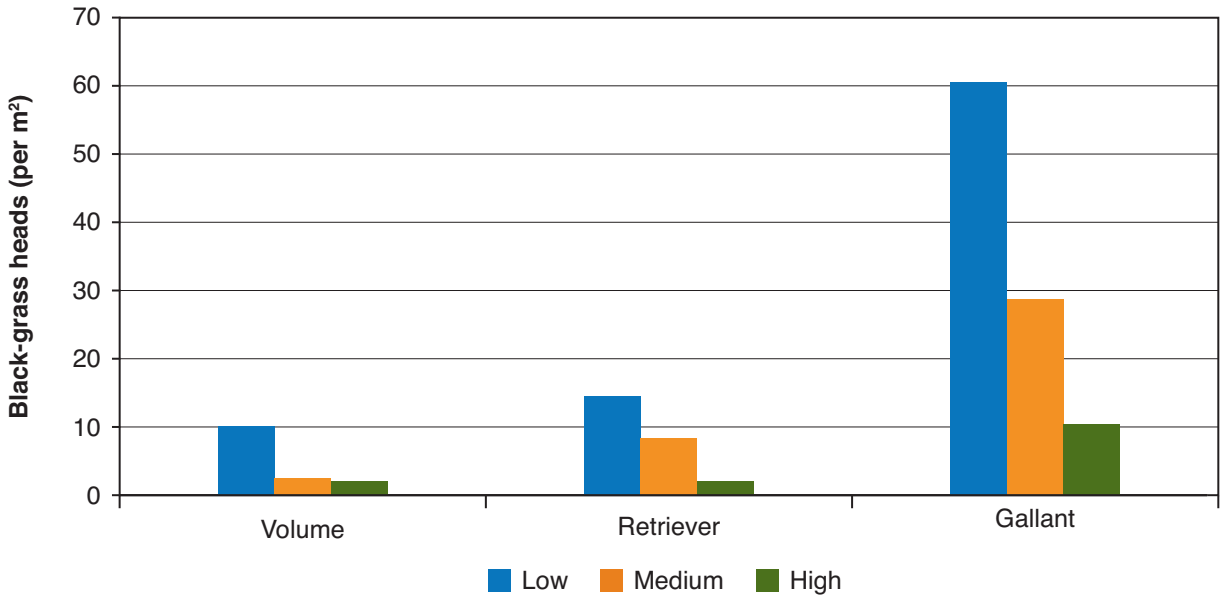
Hybrid varieties – 200 plants/m² (e.g. 250 seeds/m²)

As discussed above for wheat, suggested seed rates assume good seedbeds. Most winter barley crops will be sown in late September/early October, hence less variation in seed rate.

Thousand grain weights vary considerably among barley varieties, so check these carefully.

Hybrid varieties should be sown at the lower seed rates suggested, but as seen in the data below, for competition with grass weeds there are still benefits from higher plant populations so do not drill at too low a seed rate in such situations.

Figure 3. Effect of seed rate and crop/variety choice on black-grass head numbers. Cambridge 2014



The black-grass population was not high here but the effect of plant population in wheat is still clear. It is much smaller in the barley varieties but the better suppression from the hybrid is evident and Volume still responded to seed rate.

Seed rates /m² (for all three)

High – 575

Medium – 290

Low – 150

There is no further work on this topic but the 2104 data above is still relevant.

As well as a black-grass effect, similar differences between crop and variety have been seen in the presence of **meadow brome** in recent trials.

Winter oats

Plant populations of winter oats can significantly influence the standing power of the crop, so be conservative when selecting seed rates.

a) 150-200 plants/m² (e.g. 200-250 seeds/m²)

b) 250-300 plants/m² (e.g. 300-325 seeds/m²)

- The first range suggested would be the maximum for sowings up to early October.
- The second range suggested relates to later sowings which are possible in the southern half of the country. It is recommended to reduce grass weed competition, also the later sowings in this case to allow residual herbicide products (usually reduced doses in this crop) to work with optimum efficacy.
- The recently published Oat Growth Guide shows that we only require 400 panicles/m² for optimum yield and specific weight, so there is no need to push seed rates to achieve this.

9. Cereal seed treatments

The choice of seed treatments has further reduced recently, but there is still a reasonable range of products that will give good control of most seed-borne diseases. Leaf stripe in barley and leaf spot in oats are less well controlled by some products. Also the level of control of loose smut in barley varies between products. See Table 4 below for more details. All treatments are for the reduction or control of diseases that can affect establishment and are not effective on foliar diseases (except as mentioned above). Many products will also provide control of seed-borne diseases that have life cycles that manifest in the disease replacing the grain, such as bunts and smuts.

Where possible, such as when home saving seed or when offered the choice by seed merchants, it is worth having seed tested for levels of seed-borne diseases and make decisions accordingly about whether a fungicide seed treatment is required or not. Often, healthy seed can be grown without any treatment with very little risk of any problems.

For control of wireworm and wheat bulb fly, rotational position and time of sowing need to be considered. A seed treatment is now the only chemical control option for these pests.

With resistance to pyrethroids seeming to become more common in grain aphid populations, which is one of the aphid species that carry barley yellow dwarf virus (BYDV), delaying drilling of crops until mid-October where possible will act as a very useful cultural control.

Table 4. Seed treatment products for treating pests and diseases in cereals – Autumn 2019

Product	a.i. and application rate	Approved Crops*	Disease Control:	Other Comments
Seed-borne (and some soil-borne) diseases only				
Anchor	200 g/l carboxin + 200 g/l thiram 3 l/tonne	wheat, barley, oats, rye and triticale	Covered smut, bunt, septoria and fusarium seedling blights, some leaf stripe and loose smut control.	Use by 30 January 2020.
Beret Gold	25 g/l fludioxonil 2 l/tonne	wheat, barley, oats, rye, and triticale	Control of some smut spp., bunt, septoria and fusarium seedling blights, some leaf stripe control and some oat leaf spot control.	Not good on loose smut, and control of leaf spot (oats) and leaf stripe (barley) not good enough for seed crops.
Celest Extra	25 g/l difenoconazole + 25 g/l fludioxonil 2 l/tonne (1.5 on rye)	winter wheat, winter oats, and winter rye	Septoria and fusarium seedling blights, bunt. Striped smut in rye. Leaf spot in oats.	
Difend Extra	25 g/l difenoconazole + 25 g/l fludioxonil 2 l/tonne	winter wheat	As Celest Extra	
Fountain	50 g/l fludioxonil + 10 g/l tebuconazole 1 l/tonne	winter wheat, winter barley, winter oats, winter triticale and rye.	Similar to Beret Gold. Improved control of smuts.	Loose smut control in barley not good enough for use in crops for seed.

Rancona 15 ME	15 g/l ipconazole 1 l/tonne on wheat and 1.33 l/tonne on barley	wheat and barley	Loose smut in barley, bunt in wheat and reduction of fusarium seedling blights, some leaf stripe control in barley.	Compatible with Signal 300 ES.
Rancona i-MIX	20g/l ipconazole + 50 g/l imazalil 1 l/tonne	wheat and barley	As Rancona 15 ME with better leaf stripe activity.	Not on crops sown between 1 February and 31 August.
Raxil Star	20 g/l fluopyram + 100 g/l prothioconazole + 60 g/l tebuconazole 0.5 l/tonne	winter barley	Smuts, leaf stripe, seed-borne net blotch, and fusarium seedling blights.	Not on crops sown between 1 February and 31 August.
Redigo Pro	150 g/l prothioconazole + 20 g/l tebuconazole 0.67 l/tonne	wheat, barley, oats, rye, triticale and durum wheat.	Covered and loose smuts, bunt, and fusarium seedling blights, and some leaf stripe control. Limited evidence for reduction of ergot germination.	Replaces Redigo and Redigo Deter. Control of leaf stripe in barley not good enough for seed crops.
Vibrance Duo	25 g/l fludioxonil + 25 g/l sedaxane 2 l/tonne (1 l/t in spring oats)	winter wheat, winter triticale, winter rye and spring oats.	An improved version of Beret Gold. Not authorised for all cereals though. Controls loose smut in winter wheat and spring oats.	Improved vigour of establishment over Beret Gold claimed.
Take-all reduction				
Latitude	125 g/l silthiofam 2 l/tonne	winter wheat, spring wheat and winter barley. Also an EAMU on triticale, durum wheat and rye.	Take-all reduction. Needs to be co-applied with another seed dressing for wider disease control.	For resistance management, maximum of three consecutive treatments within a crop rotation.
Take-all reduction				
Austral Plus	10 g/l fludioxonil + 40 g/l tefluthrin 5 l/tonne	wheat, barley and oats. Also an EAMU on triticale.	Disease control as per Beret Gold. Reduction of damage from wireworm and wheat bulb fly.	Only option for wheat bulb fly and wireworm control for crops sown after the end of January.
Signal 300 ES	300 g/l cypermethrin 2 l/tonne	Autumn or winter sown wheat and barley.	Reduction of damage from wheat bulb fly and wireworm. Can be co-applied with some fungicide seed treatments for seed-borne disease control.	Not for crops sown after 31 January. Check compatibility of any other products co-applied (Anchor and Rancona 15 ME are compatible).

Table Notes

* Where a product is only approved on either winter or spring varieties, this is specified. Where approval is for both, just crop species is mentioned.

Where fusarium control is mentioned, this will also include *Microdochium nivale* (which is also called *Monographella nivalis*).

There is some concern about reduced sensitivity of loose smut in winter barley to seed treatments, especially triazoles. Raxil Star is therefore probably the strongest option for this disease.

Leaf spot in oats – strongest product is Celest Extra.

EAMU = Extension of Authorisation for Minor Use. Use is at grower's risk and the user must have a copy of the relevant EAMU document before use. These are available to download from **https://secure.pesticides.gov.uk/offlabels/search.asp**

Seed treatment stewardship – Key points

Stewardship promotes best practice, which helps achieve best efficacy and reduce the environmental impact from seed treatment products.

- Do not broadcast treated seed.
- Avoid leaving seed on the soil surface by careful placement and avoiding excessive drill speeds. The latter point is particularly important in stony or cloddy soils.
- Take care when loading the drill, avoiding release of seed from excessive height, for example. Any excessive handling will increase abrasion and dust.
- Clean up spills immediately, and do not load the drill where such clean-ups will be difficult (e.g. on grass). Check headlands in particular of fields after drilling for any exposed seed and cover with soil.
- Try to avoid spillage from the drill when lifting and turning on headlands.
- Wear appropriate protective clothing and correctly set up and calibrate drills.
- If necessary, check manufacturer's information regarding specific hazards and their mitigation. This is often available via stewardship information on company websites or technical assistance telephone numbers.

NIAB is a leading UK centre for plant science, crop evaluation and agronomy, with headquarters in Cambridge and regional offices across the country. NIAB spans the crop development pipeline, combining within a single resource the specialist knowledge, skills and facilities required to support the improvement of agricultural and horticultural crop varieties, to evaluate their performance and quality, and to ensure these advances are transferred into on-farm practice through efficient agronomy.

With an internationally recognised reputation for independence, innovation and integrity, NIAB is ideally placed to meet the industry's current and future research, information and knowledge transfer needs.

We conduct field crops research and provide impartial variety and crop husbandry information. Our knowledge base is drawn from extensive staff expertise, research data and field trials from ten regional centres across the UK.

For more information log onto www.niab.com

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